# ENTOMOLOGICAL NEWS

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# ENTOMOLOGICAL NEWS

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## The Terminology of Phallic Structures in the Cyrtacanthacridinae (Orthoptera, Acrididae)

DAVID C. EADES,[1] Academy of Natural Sciences of Philadelphia

There have been three major studies of the phallic structures of grasshoppers, the first by Snodgrass in 1935, the second by Roberts in 1941, and the third by Dirsh in 1956. In his paper Roberts presented a terminology which unified, so far as practical, the terminology of Snodgrass and the isolated earlier works. This terminology was almost universally accepted until 1956 when Dirsh made several basic changes. In papers appearing since 1956 the terminology has been confused; some authors followed Roberts, others followed Dirsh, and Hubbell (1960)[2] modified Dirsh's terms. However, none of the authors since 1956 discussed reasons for his choice of terms. This confusion makes it obvious that more work is needed. A thor-

[1] The author wishes to express his appreciation to James A. G. Rehn and H. Radclyffe Roberts for their generous help and encouragement in the preparation of this paper. Also, V. M. Dirsh, T. H. Hubbell, and Ashley B. Gurney have read the manuscript and offered many valuable comments.

[2] In fairness to Hubbell it should be stated that the study of the terminology of phallic structures was entirely incidental to the purpose of his paper and that a critical analysis of terms was not intended. Nevertheless, his paper is discussed here because he originated terms and, in the case of the arch and the zygoma, it helps to demonstrate that when previous definitions are not sufficiently precise, terms can gradually change meanings without authors being aware of it.

ough analysis of homologies among the various groups of grasshoppers would be highly desirable, but to prepare such an analysis would be an undertaking of major proportions. Rather than abide with the present confused situation until homologies have been established, the present paper undertakes the more modest task of trying to stabilize terminology in a single subfamily, the subfamily Cyrtacanthacridinae (= Catantopinae). The phallic structures of the Acridinae are sufficiently similar that homologies are apparent, but this latter subfamily is not specifically included because the author has done very little work in it. These two subfamilies comprise the dominant groups of grasshoppers of the world and, with respect to the phallic structures, the best known. As homologies of structures of other groups become better understood, this terminology can be applied to them or modified as necessary. In most cases the terms of Roberts are selected as more appropriate than those of Dirsh and better known and less cumbersome than those of Snodgrass. In several cases, however, it is necessary to incorporate modifications of Snodgrass' terms to allow distinctions not provided for by more recent authors. For specific examples of the new terminology, see papers by Rehn and Eades (*Notulae Naturae* No. 345 and *Proc. Acad. Nat. Sci. Phila.*) and Gurney and Eades (*Trans. Amer. Ent. Soc.*) now in press.

It is sometimes useful to visualize the phallus in terms of concentric rings of indentation and lobes of ectoderm. All sclerotized structures must develop in ectoderm, and the homologies of sclerites may best be understood by determining what portion of the ectoderm is involved. All the major authors understood these principles and made use of them in a number of places. Nevertheless, more rigorous use of them would have saved a number of errors. To facilitate discussion, let us begin in the center and proceed outward using the analogy of concentric folds. This is done for convenience in presentation and is not intended to imply any basic radial symmetry. "Indentation" and "lobe" refer to the final result without implying developmental processes.

CENTRAL INVAGINATION—THE ENDOPHALLIC MEMBRANE

Snodgrass made a useful distinction which has been lost by all subsequent authors. His *apical processes of aedeagus* were structures which projected around the posterior opening of the phallotreme. On the other hand, he used *lateral sclerites of phallotreme cleft* for the solidly sclerotized structures in the phallotreme membrane. I will use *dorsal* and *ventral aedeagal sclerites* for these solidly sclerotized structures, which are totally derived from endophallic membrane but commonly extend into the projecting lobes (see Fig. 1). For the lobes I will use the terms *dorsal* and *ventral aedeagal valves*. The aedeagal valves may be membranous, sclerotized, or partly sclerotized and are derived from both ectophallic and endophallic membrane. *Dorsal* and *ventral* are used in relation to "normal" positions. In forms which are strongly modified, the dorsal aedeagal sclerites may be recognized by their being continuous with the arch. The dorsal and ventral aedeagal valves may be recognized by the fact that they contain the distal portions of, respectively, the dorsal and ventral aedeagal sclerites. As Dirsh points out (*in litt.*), *aedeagus* is a general term for the distal part of the whole phallic complex and would therefor include any distal projection. However, for the sake of conforming as nearly as possible to past usage, I prefer to restrict *aedeagal valves* to structures at the distal end of the phallotreme. If there should be any need for the broader sense, something such as "aedeagal lobes" may be defined and used.

In view of the considerable confusion regarding these structures, a list of terms of various authors seems useful. *Dorsal aedeagal sclerites:* anterior (dorsal) lateral sclerites of phallotreme cleft of Snodgrass; dorsal aedeagal valves in part of Roberts; valves of cingulum in part of Dirsh as used in his Pauliniidae and Acrididae; dorsal penial valves in part of Hubbell. *Dorsal aedeagal valves:* anterior (dorsal) apical processes of aedeagus of Snodgrass; for remaining authors the same terms as listed above for dorsal aedeagal sclerites. *Ventral aedeagal sclerites:* posterior (ventral) lateral sclerites of phallotreme cleft of Snodgrass; ventral aedeagal valves in part

of Roberts; apical valves of penis in part of Dirsh and of Hubbell. *Ventral aedeagal valves:* posterior (ventral) apical process of aedeagus of Snodgrass; ventral aedeagal valves in part of Roberts; apical valves of penis in part of Dirsh and of Hubbell.

With these terms defined, it is now possible to discuss Dirsh's objections to Roberts' terms, primarily to Roberts' use of *dorsal aedeagal valves.* Dirsh stated (p. 231): "From the zygoma region of the cingulum (Pl. 2, fig. 5) or from the arch (Pl. 2, fig. 9) there often arises a pair of valves, situated above the penis valves and parallel to them. Snodgrass (1935) and Radclyffe-Roberts (1941) called them the dorsal valves of the aedeagus, but they actually belong to the cingulum." In the case of the Romaleinae, however, Dirsh substituted *appendices of aedeagus* for *dorsal aedeagal valves.* In his definition Dirsh stated (p. 226) that the *valves of cingulum* are "morphologically derived from the ectophallus." The basic points of disagreement are whether the dorsal aedeagal sclerites are derived from endophallic or ectophallic membrane and whether or not the arch is part of the cingulum. Dirsh stated (p. 227, definition of *penis,* which in the sense of Dirsh includes the ventral aedeagal sclerites as here understood) that the ventral aedeagal sclerites are derived from endophallic membrane. Nevertheless, he maintained that the dorsal aedeagal sclerites (included in his concept of *valves of cingulum*) are ectophallic. This would require that the ventral portion of the phallotreme is endophallic and the dorsal portion ectophallic or else that a diverticulum develops from the ectophallic membrane, grows down what is to be the arch, and expands to form the dorsal aedeagal sclerites, which fuse with the phallotreme membrane. Both of these interpretations are strongly contradictory to the apparent situation and to the concepts of previous authors. In many cases the arch and dorsal aedeagal sclerites form a continuous sclerite which is not continuous with the cingulum (except by membrane). (See the description of a new species of *Leptysma* in Rehn and Eades, *Proc. Acad. Nat. Sci. Phila.,* in press.) The only evidence which tends to support Dirsh is the possible

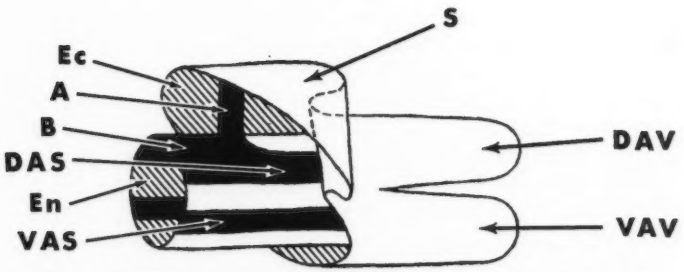


FIG. 1. Diagram of the distal portion of the phallus of a typical grasshopper of the subfamily Crytacanthacridinae (dorsal and ventral phallotreme clefts not shown). A, arch. B, bridge. DAS, dorsal aedeagal sclerite. DAV, dorsal aedeagal valve. Ec, ectophallic membrane. En, endophallic membrane. S, sheath. VAS, ventral aedeagal sclerite. VAV, ventral aedeagal valve.

homology of the dorsal aedeagal sclerites to the *valves of cingulum* in his Charilaidae, Proscopiidae, and Pyrgomorphidae. Such a homology would be dubious on anatomical grounds alone, but the phylogeny of Dirsh (or anyone else) shows his *valves of cingulum* to be of clearly polyphyletic origin (unless they were retained from the common ancestor of the entire superfamily, which is most unlikely). Therefore Dirsh's interpretation with respect to the dorsal aedeagal sclerites in his Acrididae and Pauliniidae should be rejected.

Another term with a confused history is *arch,* although in this case there is no indication that any author was aware of any change in the use of the term. Snodgrass stated (p. 64) that the dorsal aedeagal sclerites "are connected with each other by a strong transverse arch (*t*) in the dorsal wall of the passage," *i.e.,* the phallotreme. This description applied to his *bridge of anterior phallotreme sclerites* as indicated by the fact that he gave this term in his explanation of "*t*" in the set of drawings to which he referred in the above quotation. Roberts defined his *arch of dorsal valves* (p. 241) as a connection between the dorsal aedeagal sclerites and the zygoma of the cingulum and considered the *bridge of anterior phallotreme sclerites* of Snodgrass as a synonym. The *bridge* of Snodgrass connects right

and left dorsal aedeagal sclerites and develops in the dorsal portion of the phallotreme membrane and spermatophore sac. The *arch* of Roberts connects ventrally with the dorsal aedeagal sclerites and the bridge and extends dorsad, usually fusing to the mid-dorsal region of the cingulum. In the forms for which I have made detailed dissections, it is derived from the anterior end of the dorsal phallotreme cleft (the cleft between the dorsal aedeagal valves). The bridge and the arch are often fused so closly that the distinction is rather trifling. Nevertheless, the distinction is useful for descriptive purposes, and the ontogenetic origin is different. The bridge, arch, and dorsal aedeagal sclerites are continuous portions of a single sclerite which has not been named.

Dirsh defined his *arch of cingulum* (p. 225) in the same sense as the *arch of dorsal valves* of Roberts; however, most of his figures were labelled in such a way as to suggest the bridge rather than the arch. Hubbell, apparently working from Dirsh's figures, labelled what is clearly the bridge (fig. 1b, p. 30) as the *arch*. The true arch was labelled as the *attachment to zygapophysis*. I am unable to find any definition of *zygapophysis*, but I would presume it referred to a ventral diverticulum from the zygoma. The existence of such a diverticulum is implied by the terminology of Dirsh, but I know of no evidence to indicate that it actually does exist.

The spermatophore sac possesses a single pair of sclerites, the *endophallic plates*. Dirsh and Hubbell referred to these as *basal valves of penis*, but this term should also be rejected for the sake of consistent terminology. The term *endophallic plate* refers to the entire sclerite but has often been used for certain portions of it in spite of the fact that Snodgrass provided the necessary terms. He referred to the flared anterior portion as the *anterior apodeme of endophallic plate*, but *endophallic apodeme* is adequate. The central portion lying against the spermatophore sac is the *lateral plate*.

### First Ring of Lobes

This ring includes the aedeagal valves as redefined above. The inner sides are part of the phallotreme membrane and may

or may not be sclerotized. The outer sides are part of the ectophallic membrane and are often coriaceous but normally not sclerotized unless fused to the aedeagal sclerites.

### First Ring of Indentation

This ring is included here because it is usually present dorsally and laterally in the Cyrtacanthacridinae. Its presence in other groups is open to question. It does not contain any important structures.

### Second Ring of Lobes

This ring contains the *sheath*. As understood by Roberts and Dirsh, the *sheath* extends from the rami of the cingulum to the point where the ectophallic membrane of the aedeagal valves is sclerotized, or if it is not sclerotized, to the junction with the endophallic membrane. By this definition the extent of the sheath varies greatly according to whether or not the ectophallic membrane of the aedeagal valves is fused to the aedeagal sclerites. I would prefer to think of the sheath as extending from the rami only to the aedeagal valves. When the first ring of indentation is present, it serves as the dividing line. When the first ring of indentation is absent, a more or less arbitrary division must be made; the aedeagal valves are the projecting, intromittent part.

### Second Ring of Indentation

This ring contains a well developed sclerite, the *cingulum*, which typically includes the *zygoma* and paired *apodemes* and *rami*.

The term *zygoma* has developed a double meaning. In the sense of Snodgrass (p. 64) it was "a strong transverse sclerotic bridge." Roberts and Dirsh labelled their drawings in conformity with this except for Dirsh's Plate 32, figure F, where the zygoma was indicated posterior to a membranous area. However, this was probably just a slip because Plate 32, figure D showed the zygoma anterior to this membranous area. On

the other hand, the *zygoma* has also been thought of as the general mid-dorsal region between the bases of the apodemes and rami regardless of whether it is sclerotized or not. It was this latter sense which Roberts and Dirsh were apparently using in their definitions of *zygoma* and when they stated in their definitions of *arch* that the arch connects with the zygoma. It is definitely this latter sense which Hubbell used when he stated (explanation of Plate XVII) that his "basal eminence" is the summit of the zygoma. (Hubbell stated on page 29 that his "basal eminence" has a membranous surface.) It seems wisest to return to the more precise concept of Snodgrass, who first used the term, and exclude membranous areas from the zygoma. However, a membranous area is sometimes so nearly enclosed by the zygoma and rami that it can hardly be excluded from the cingulum. The term *central membrane of cingulum* seems appropriate to solve this difficulty. If there should be any need to refer to the broader concept of *zygoma,* a description such as "mid-dorsal region of cingulum" should be sufficient.

Roberts stated (p. 245) that the ventral infold "is comparable to the invagination on the dorsum of the pallus which gives rise to the rami and zygoma of the cingulum." This is in conflict with his usage in his Cryptosacci where he shows it ventral to the ventral lobe and therefore part of the third ring of indentation. Roberts informs me (in conversation) that his concept of *ventral infold* agreed with his usage and not with the above quotation. In some cases there are two ventral invaginations, one in the second ring of indentation and one in the third ring. The definition of Dirsh (p. 228) is of no help as it is vague enough to include both of the ventral invaginations and the ventral lobe. The logical solution is to restrict the term *ventral infold* to the concept of Roberts in his Cryptosacci, *i.e.,* the invagination ventral to the ventral lobe and to whatever invagination may prove homologous to this. The invagination in the second ring of indentation may prove to be present only in occasional genera and may be referred to as a supplementary ventral infold unless future work shows it to be of wide occurrence. I am not prepared to state which invagination in Roberts' Cryptosacci is homologous to the "ventral infold" in his Chasmosacci.

### Third Ring of Lobes

The dorsal lobe of this ring is called the *basal fold* and is normally not sclerotized. The lobes on the sides (when present) are called the *lateral lobes* and commonly bear sclerites. When the lateral lobes are joined ventrally, they may be called the *ventral lobe*. When the second ring of indentation is sufficiently weakened, the lateral lobes or ventral lobe may fuse with the cingulum. The *ventral fold* of Dirsh is the ventral lobe as here understood. The *ventral lobe* of Dirsh is confusing. In most cases it seems synonymous with his *ventral fold*, but in the case of *Paulinia* (Pl. 29) a portion of the sheath is labelled as the ventral lobe.

### Third Ring of Indentation

The ventral invagination of this ring is the *ventral infold* and has already been discussed. The *epiphallus* and associated sclerites are found on the ventral side of the dorsal portion of this ring of indentation. For these structures the terminology of Dirsh is fully adequate and acceptable in so far as I have investigated them. An invagination is often present immediately anterior to the epiphallus and may be called the *epiphallic infold*. This term refers to the position of the invagination; the invagination does not contain the epiphallus.

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# An Improved Technique for Using the Berlese Funnel

By M. W. McFadden, University of Alberta,
Edmonton, Alberta, Canada

The Berlese funnel is probably familiar to every entomologist. It is a useful tool but unfortunately has two serious limitations: it is not portable and too much time is required (often four days) to drive all specimens from a substrate sample. However, by making use of certain chemicals and a different type of construction these limitations have been eliminated.

In the past, without portable Berlese funnels, specimens had to be either collected directly or the duration of the field trip had to be limited if habitat samples were taken. This latter choice was necessary since temperature, moisture and oxygen requirements of the insects restricted the length of time a sample could be retained before being run through the Berlese funnel.

The slowness of the Berlese funnel technique as applied in the past can be attributed to the fact that heat, light, or gravity is required to drive the insects from the sample. However, Dr. Brian Hocking of this university has recently pointed out to me, that by using a mixture of three parts naphthalene and one part paradichlorobenzene, it is possible to drive out the insects in a relatively short period of time.

The modified apparatus consists of a wooden frame with interchangeable screen filters. The lower portion of the frame is covered with plastic sheeting in the form of a cone. Two of these funnels are bolted to a stake or shaft as shown in fig. 1. The shaft is either driven or dug into the ground and the samples placed on the screen filters in the funnels. Five tablespoons of the chemical mixture are then sprinkled over each sample, the top swung into position and collecting jars set underneath the cones. All specimens are driven from the sample in approximately twelve hours, depending, of course, on the nature of the sample.

As many as five sets of these funnels can be carried in the trunk of a car so that collecting can be carried on during the

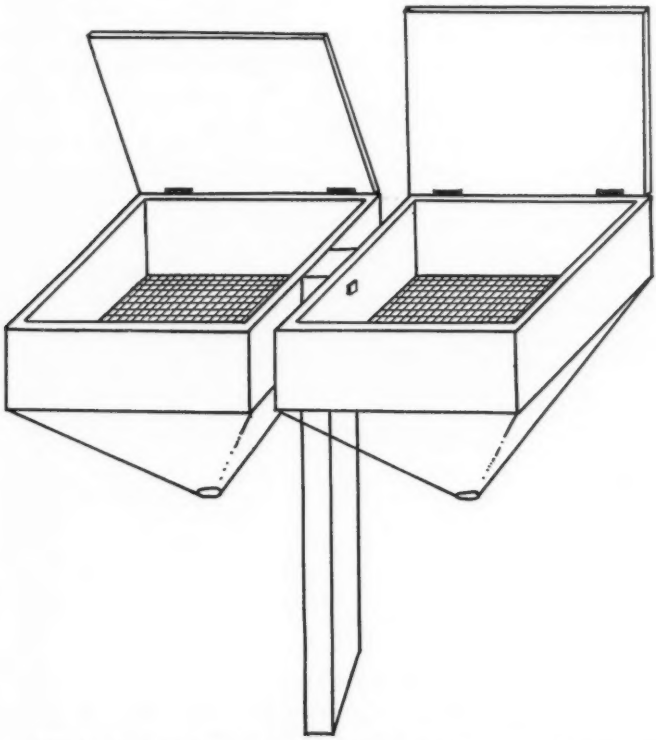

FIG. 1. The top or wood portion of the funnel is nine inches square and three inches deep; the entire apparatus is three feet high (from top of box to base of stake).

day and habitat samples brought back to the camp in plastic bags to be run through that evening. In this way specimens can be removed in the morning and the rest of the day can be used for collecting.

The above mentioned technique has been used to collect dipterous larvae, especially Stratiomyidae, but in the course of this work adults and/or larvae of Coleoptera, Odonata, Hemiptera, and Collembola also have been obtained. This tech-

nique was successful with such diverse samples as heavy muck, various manures, decaying wood, moss, forest duff, and shore debris. The fumes from the naphthalene and paradichlorobenzene seem to have little or no effect, at least upon Stratiomyid larvae, as far as rearing is concerned.

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## An Observation of the Behavior of Telamona compacta Ball Preceding and During Oviposition. (Homoptera, Membracidae)

By Clifford J. Dennis, East Central State College, Ada, Oklahoma

These observations were made at Itasca State Park, Minnesota, on July 27, 1960, at the campground of the University of Minnesota Biological Station during work which was supported in part by a grant from the National Science Foundation.

Weather conditions during the time of observation were as follows: temperature 82 degrees, wind northwest 3–4 mph, sky clear.

A female *Telamona compacta* Ball was discovered at 1:37 p.m. CST on a bur oak, *Quercus macrocarpa* Michx., six feet above the ground, three inches from the tip of the branch. She was on the top of the branch, nearly parallel with it and facing toward its base. Her position was on the sunnny, south side of the tree, but she was shaded except for the time from 2:38 until 3:35 when she was in intermittent sunlight. The abdomen of this insect was noticeably distended and somewhat pendulous posteriorly.

At 1:55 she raised the posterior part of the body about one-fourth inch and then lowered it. This action was repeated at 2:05, 2:11, 2:23, 2:42, 2:44, 2:50, and 2:57. At 2:44 she also flicked her wings slightly as a breeze shook the branch.

At 3:04 she abruptly extended her legs and elevated her entire body straight upward in a horizontal position. While in this posture she jerkily raised the knee of the left hind leg several times. The original position was resumed at 3:06.

The rear of the body was again raised and lowered at 3:10.

At 3:11 she very slowly raised her entire body to the horizontal position; this required three minutes. This posture was maintained until 3:18 when she dropped to her original position.

She raised her entire body halfway to the full height at 3:21. At 3:22 she started gradually to resume the original position and attained it at 3:24.

The posterior end of the body was again raised and lowered at 3:28.

This behavior seemed to be a kind of a warm-up for the task that lay ahead. She started to move toward the base of the branch at 3:35. Her progress was not direct. There were several stops and starts and some wandering around on the branch. By 4:35 she had progressed about two feet toward the base of the branch and had reached an area of corky protuberances at which point the branch was about one inch in diameter.

At 4:35 she was on top of this branch facing its base and made what appeared to be a tentative effort to oviposit. She unsheathed her ovipositor, raised her posterior end and positioned the ovipositor at right angles to her body. The ovipositor was then stabbed directly downward to pierce the bark tissue between corky ridges. She appeared to bounce up and down while inserting it to its full length. Withdrawal of the ovipositor occurred almost immediately; it was not sheathed completely until about thirty seconds had elapsed.

She then walked to the corky region on the top of a similar adjacent branch, taking a position facing its base. Here, at 4:45, she began striking oviposition activity. In a smoothly coordinated fashion she raised her entire body (especially the posterior end), flexed her abdomen slightly, extended the ovipositor perpendicularly to her body and quickly stabbed this structure its full length into the stem between two corky ridges. Almost immediately she withdrew the ovipositor slightly and

then fully inserted it again as she began a pumping action of the abdomen. The pumping action was continued until the ovipositor was finally withdrawn. During the time the ovipositor was inserted, the venter of the abdomen anterior to the base of the ovipositor was inclined abruptly away from the branch; the venter of the abdomen posterior to the base of the ovipositor was closely appressed to the bark. This gave the impression that she was sitting down on the bark. At 4:50 she slightly withdrew the ovipositor; at 4:51 it was again fully inserted. Similar withdrawal and insertion were repeated at 4:52 and 4:53, respectively. At 4:53:30 the ovipositor was fully withdrawn and sheathed in a smooth action which was the reverse of the insertion behavior. The insertion and withdrawal actions gave the impression of flowing, graceful motion.

The third valvulae were not inserted. These could be seen flicking as the abdomen was pumping.

The insect remained motionless eight minutes and then moved one inch to its left to the side of the branch, still facing its base, and began to oviposit at 5:04. Her behavior resembled that of the preceding instance except that she partially withdrew the ovipositor only once. This activity was completed at 5:07.

Similar behavior was observed twice more. One instance occurred from 5:21 to 5:25 on the underside of a somewhat smoother, slender part of the stem. The other took place in a corky region on the top of a slender branch, starting at 5:45. This one was not completed because I disturbed the insect while trying to obtain a closer look. My inquisitiveness caused her to fly off and become lost.

The time, place, and mechanics of the oviposition proper agree generally with those briefly reported for *Telamona* by Funkhouser (1917). However, this insect was more easily disturbed than he indicated.

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# Concerning the Neogeophilidae, with Proposal of a New Genus.[1] (Chilopoda: Geophilomorpha: Neogeophilidae)

By R. E. Crabill, Jr., U. S. National Museum, Smithsonian Institution, Washington, D. C.

In 1918 Filippo Silvestri proposed as new two remarkable genera, *Neogeophilus* and *Evallogeophilus,* and assigned them to a new geophilid subfamily, Neogeophilinae. He observed that the Neogeophilinae were to be distinguished from all other geophilids by their second maxillary coxosterna which are completely divided midlongitudinally, each bearing anteriorly a pair of peculiar uniarticular, lobate structures in place of the usual telopodites, associated medial projections, and lappets. The distinctiveness of his new forms, he explained, was further enhanced by their bizarre pretarsal modifications: each of the more anterior pretarsi bears a sizeable tooth projecting from the ventral arch of the pretarsal claw proper. Each of these three characteristics was unknown to occur within the Geophilidae, and their combination was, and remains, common only to the Neogeophilidae.

In 1926 Attems elevated the Silvestri subfamily to full family rank but cautioned that family status must remain provisional prior to a more detailed presentation of distinctive features. In his ordinal monograph of 1929 Attems summarized what was known of the neogeophilids—somewhat inaccurately, as we shall see—but continued to accord to them full family status. Since 1929 no new species have been referred to the family, and no new evaluation of the Silvestri specimens has been issued. The matter rests as Dr. Attems left it: the rank of the suprageneric, collective category to which the Silvestri genera and the present new genus are referable remains provisional.

*Neogeophilus* and *Evallogeophilus* were founded upon two species, which in turn were based upon three specimens. To these may now be added a fourth specimen, representing a new

[1] This study was undertaken with the aid of a grant from the National Science Foundation (G9805).

species and, evidently, genus. This newst neogeophilid was discovered among some undetermined, miscellaneous material that was collected moré than fifty years ago in Guatemala and sent to O. F. Cook, whose interests by that time had shifted nearly completely from Chilopoda to Diplopoda and botany. Dr. Cook labelled the specimen as a *"Geophilus,"* then put it aside, apparently without further attention. This specimen manifests the same distinctive higher categorical characteristics that Silvestri recognized in his two species. In addition to these diagnostic family characters that Silvestri specified, there is another of considerable significance that he failed to cite. The basal article of the second maxillary telopodite is entirely without dorsal and ventral condyles. They are absent in the present, new form, and, according to his figures, they are absent in his two species.

**CRYPTOSTRIGLA**, new genus

Differential Diagnosis.—The new genus, while sharing some significant characters with each of the other genera, seems more reminescent of *Evallogeophilus* than of *Neogeophilus.* At the same time it manifests certain features seen in neither of the Silvestri genera. The presence in *Cryptostrigla* of the following features will readily distinguish it from *Neogeophilus:* ultimate pedal pretergite and pregenital sternite are indistinctly separated from their respective, adjacent plates; the subcondylic sclerotic lines of the prosternum are abortive and incomplete, hence do not pass across the prosternal corner to or toward the telopodite condyles; the female gonopod consists of one article, the two constituent articles having fused without discernible trace of an intervening suture.

The following generic characters are common both to *Evallogeophilus* and *Cryptostrigla:* prosternal denticles are present; the ultimate pedal pretergite is completely or almost completely amalgated with its tergite; the ultimate pedal sternite is completely or almost completely amalgamated with the pregenital sternite; the paraclypeal sutures do not diverge outward posteriorly (see discussion under Notes). These two genera differ, at least, as follows. *Evallogeophilus:* (1) prosternal subcon-

dylic sclerotic lines pass toward and meet or nearly meet the basal prehensorial condyles; (2) each female gonopod is distinctly biarticulate, the interarticular suture being persistent; (3) ultimate pedal pretergite is apparently wholly fused with its tergite (see Silvestri's Figs. 6, 9, p. 357: see discussion under Notes below); (4) ultimate pedal sternite apparently wholly fused with the pregenital sternite (see Silvestri's Figs. 7, 10, p. 357). *Cryptostrigla:* (1) prosternal subcondylic sclerotic lines are abortive and coincident with part of the pleuroprosternal sutures, the former neither meeting nor passing toward the prehensorial condyles; (2) each female gonopod manifests no discernible interarticular suture, the two constituent articles having fused without trace of division; (3) the ultimate pedal pretergite is intimately fused with its tergite, but the intervening transverse suture, although obscure and vestigial, is persistent and readily discernible under optimum conditions of observation; (4) the ultimate pedal sternite is intimately fused with the adajacent pregenital sternite, but the intervening suture, although extremely obscure and vestigial, is still discernible but with difficulty.

See also the family résumé at the end of the article, where the generic diagnostic features are presented comparatively in tabular outline.

Type-species: *Cryptostrigla silvestri,* new species. (Present designation and monotypic).

Notes.—In his original description of *Evallogeophilus,* Silvestri characterized its ultimate pedal dorsal sclerite as follows, relying heavily upon this particular generic criterion for distinguishing between it and *Neogeophilus* (p. 357): "Genus hoc a genere *Neogeophilus* tergito segmenti ultimi pediferi praetergito destituto, . . . ." He reported that the pretergite was absent, as indeed his figures 6 and 9 show it to be. Yet, comparing these figures with their counterparts for *N. primus* (p. 353, Fig. 13), the reader will see that the ultimate pedal tergite of *mexicanus,* which appears abnormally long, actually represents that tergite *plus its associated pretergite.* In other words, in *mexicanus* the pretergite and tergite are entirely amalgamated

without discernible intervening suture, or, if there is a suture, it is so vague that it escaped Silvestri's notice. Clearly, this degree of amalgamation does not typify *primus,* whose intertergital suture he recognized and figured in Fig. 13.

In *Cryptostrigla silvestri* the pretergite and tergite are intimately fused, but the intervening transverse suture is both persistent and, though obscure, easily visible after mounting in Hoyer's fluid and under optimum conditions of observation.

A similar explanation is almost certainly pertinent to the absence of certain ventral ultimate plates and sutures in *mexicanus.* On page 356 Silvestri wrote: ". . . sterno subaeque longo atque ad basim lato, lateribus paullum convergentibus, postice aliquantum sinuato, *tergito praetergito nullo,* . . . ." If the reader will compare Fig. 16 on p. 353 (of *primus*) with its counterpart, Fig. 10, p. 357 (of *mexicanus*), he cannot but be struck by the facts, first, that the ultimate pedal sternite of *primus* is notably shorter and wider than that of *mexicanus;* secondly, that the pregenital sternite of *primus* (Fig. 16) is entirely absent in *mexicanus* (Fig .10). Without much doubt, what Silvestri took to be the ultimate pedal sternite of *mexicanus* was, in fact, that sternite plus the following pregenital sternite with which it is intimately fused. The same is true in the case of the female (Fig. 7, p. 357), whose pregenital sternite is apparently absent and whose ultimate pedal sternite is abnormally long. In summary, one of two explanations must be true in the case of *mexicanus,* either: (1) the two plates are completely amalgamated without trace of an intervening suture, or; (2) the two plates are intimately fused but still separated by an intervening, vestigial suture that escaped Silvestri's notice. As has already been noted, in *C. silvestri* there is intimate fusion of the dorsal and of the ventral plates, but in each case there is a visible, vestigial suture testifying to what has happened.

Silvestri's original figures necessitate raising two additional queries. In each of these two instances we are confronted with the same question: Does the figure of the character appear extraordinary because it actually is, or rather because it was misrepresented by the artist?

In two figures (Fig. 13, p. 353, Fig. 13, p. 355) Silvestri has

shown the anterior surfaces of two representative pretarsi that are typical of his two new species. In each figure the anterior accessory spine is depicted as being very long, rather sinuous, apically abruptly pointed, or even notched apico-ventrally, and apparently hyaline or semi-translucent. In short, as he has figured them, these spines seem somewhat like long, fleshy lappets. One cannot help but wonder whether the anterior accessory spines have been misrepresented. In *Cryptostrigla silvestri* this accessory spine on all legs is perfectly straight and never sinuous; it is never notched apically or abruptly attenuate, and, what is most important, it is typically spinelike and quite opaque.

Secondly, note that in *primus* (Fig. 2, p. 353) the artis has shown the paraclypeal sutures to diverge outward posteriorly far beyond the rear clypeal margin. If this representation is accurate, then we are confronted with a remarkable departure from the usual case, wherein the two paraclypeal sutures, when complete, terminate at or near the posterolateral clypeal corner. If these sutures are as Silvestri has shown them, then they must be accorded preeminent significance as a generic criterion.

Finally, mention should be made of several important errors which Attems seems to have injected into his summary of the family (1929, p. 346). In his family diagnosis Attems reported that the ultimate pretarsus consists of one article. Insofar as the reader might therefore attribute this condition to all neogeophilids, his statement is misleading. In all known neogeophilids this character seems to be subject to intersexual dimorphism: the ultimate tarsus is uniarticulate in the known males of *N. primus* (Fig. 16, p. 353) and *E. mexicanus* (Fig. 10, p. 357), but it is biarticulate in the known females of *E. mexicanus* (Fig. 6, p. 357) and of *C. silvestri.*

Attems also characterized *E. mexicanus* (key, p. 346) as lacking a pretergite, whereas, as I have suggested above, it has a pretergite which is either wholly fused with the tergite, or else incompletely fused with it, in which latter case Silvestri's original description is in error.

(*To be continued*)

# New North American Tabanidae XIII. Change of Name for a Well-Known Species of Chrysops [1]

By Cornelius B. Philip [2]

Since the time of Osten Sacken (1875), *Chrysops univittatus* Macquart is a name assigned to a species common east of the Mississippi River and extending west to Kansas and Nebraska and north to Quebec. He states: "The identity of this species with Macquart's *C. univittatus* can hardly be called in doubt." Subsequent workers, including the writer, have followed him in this assignment. Osten Sacken also questioned the possible synonymy of *C. fascipennis* Macquart from Philadelphia, but further states: ". . . the shortness of the description renders the identification impossible."

Macquart (1855) gives the locality of *C. univittatus* as Baltimore but he did not indicate whether he had more than one specimen. A type, previously overlooked in the British Museum (Natural History) on visits by Hine, Kröber, and the author, labelled "Baltimore" and "univittatus n.sp." in Macquart's handwriting, was discovered by me on a visit in 1960. No other types were found in Macquart cabinets at the Paris and Lille Museums and it may be presumed the BMNH specimen is a holotype. No type for *C. fascipennis* has been located in any of these collections so that the relationship suggested by Osten Sacken has not been possible to verify or negate.

The *univittatus* type now lacks abdomen and antennal flagellums, but characters of the wing picture, face widely black on both sides of lateral sutures, dark scutellum, basal one-third of mid-femora and one-half of hind pair darkened, agree closely with a compared female from New York of *C. wiedemanni* Kröber. The abdominal pattern and legs, as originally de-

[1] These studies were supported by a travel grant from the March Fund of the National Academy of Sciences.

[2] U. S. Department of Health, Education, and Welfare, Public Health Service, National Institutes of Health, National Institute of Allergy and Infectious Diseases, Rocky Mountain Laboratory, Hamilton, Montana.

scribed, also agree best with *C. wiedemanni.* This unfortunate misidentification and preoccupation change the concepts of two important and common species of Nearctic *Chrysops.* There is not time, before appearance of a Nearctic catalog of Diptera, to request plenary action of the International Commission to conserve present assignments of *C. univittatus* and *C. wiedemanni.* Recourse to substitution of *C. fascipennis* for *C. univittatus* of authors, not Macquart, is not justified on present information.

Under these circumstances, *C. wiedemanni* Kröber becomes a synonym of *C. univittatus* Macquart, not of authors. For *C. univittatus* of authors, not Macquart, the new name *C. macquarti* n.sp. is proposed.

Holotype ♀, 7.0 mm. Differs from the adequate description of *C. univittatus* given by Osten Sacken (1875) in the following minor respects: Face largely yellowish, the apodemal pits and sutures narrowly brown; callosity brown; scutellum largely yellow with a small mid-basal spot. These characters are within the usually observed variation. Fig. 56 of Brennan (1935) is a good depiction of the wing pattern of this type.

Catonsville, Baltimore, Md., June 30, 1922. F. M. Root. In the collection of the author.

Allotype ♂, 6 mm. Resembles the female except the black on the parafacials larger, and infuscation of second basal cell about two thirds its length.

Riverdale, Maryland, 6–9–11. No collector. In collection of the author.

Paratype males. *New York:* 2 (reared), Oswego, June, Logothetis; 1, Ithaca, July, Evans. *Pennsylvania:* 1, Swarthmore, July, Cresson, Jr. *Wash., D. C.:* Rock Creek Park, July, Arnaud, Jr.

Paratype females. *Maryland:* 1, Hillsdale, Baltimore, July 5, 1922, F. M. Root (nearly topotypic). *Massachusetts:* 2, Leverett and Amherst, July, Coher. *New York:* 3, Wading River and Tuxedo, July and August, no collector; 6, Genesee Co., July and August, Pechuman. *New Jersey:* 4, Atsion, Francis Mills and Burlington Co., June and July, Hansens, Belkin, and Conant and Thomas. *Pennsylvania:* 4, Green Valley and Clarke Valley, June and July, Kirk and Champlain. *Virginia:* 1, Giles

Co., August, Nuttycombe. *North Carolina:* 1, Highlands, July, Byers. *Georgia:* 13, Athens, Stone Mt., Grassy Mt., Murray Co., Attapulgus, Rabun Co., and Yonah Mt., May, June and July, Loizeaux, Fattig and Sudia. *Ohio:* 11, Lancaster, Bainbridge, Vinton Co., Athens Co., Summit Co., Lucas Co., and Amherst, June and July, Goshin, Orago, Thomas and Thomas, Stehr, Campbell and Campbell, Lipovsky. *Indiana:* 2, Cass Co., June, Williamson. *Michigan:* 2, Gull Lake Biol. Sta., Kalamazoo, July, Fischer. *Florida:* Alachua Co., April and May, Dean and Stephens. *Ontario:* Puslinch, June, Pechuman.

In the U. S. National Museum, British Museum (Natural History), and collections of L. L. Pechuman and the author.

Variation occurs in which the abdominal pattern fades to obscure brown shadows in a few specimens from New Jersey, Ohio and Georgia, but these are recognizable by the wing patterns and entirely yellow femora. Varietal names do not appear to be warranted analogous to those in the *flavida* complex.

The type localities of both *C. univittata* and *C. macquarti* thus are Baltimore and indeed they fly together over a considerable proportion of their respective ranges, but are quickly separated by several characters including the more extensive apical spots and infuscated first basal cells in the latter.

Though Stone (1930) has described the immature stages of *C. wiedemanni* (= true *univittatus*), those of *C. macquarti* appear not to have been reported.

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# A New Rhinotragine Cerambycid from Arizona and Sonora (Coleoptera)

By E. Gorton Linsley, University of California, Berkeley

The Rhinotraginae comprise a group of Neotropical Cerambycidae of which more than 200 species have been described. They are of special interest to students of natural selection because of the remarkable mimetic form, coloration, and behavior exhibited by species in the various genera. These suggest an unusually wide range of models, including bees, wasps, and beetles of several families. Perhaps no comparable group of animals has developed diversified mimicry to such a degree.

Until now, no species of Rhinotragini has been known to occur within the boundaries of the United States. The species here recorded belongs to the genus *Odontocera,* as currently defined, and appears to be *O. aurocincta* Bates. However, the population occurring in Southern Arizona and Sonora appears to be subspecifically different from those in Yucatan and Vera Cruz.

**Odontocera aurocincta arizonensis** Linsley, new subspecies

Male: Integument piceous black, mouthparts somewhat rufo-testaceous, anterior tibiae, especially beneath, and intermediate and posterior tibiae at base and apex and most of antennal flagellum rufo-testaceous, first two abdominal segments testaceous, elytra with base and humeral region black, basal one-third of lateral margin black, becoming rufo-testaceous except as it approaches base, disk transparent, whitish, becoming yellowish or rufo-testaceous at apex; pubescent patches silvery white, including margins of pronotum, scutellum, median area of prosternum, and margins of meso- and metasterna. Length 17 mm.

*Holotype* male (Calif. Acad. Sci.), from Box Canyon, Santa Rita Mountains, Arizona, August 1, 1959, at flowers of a mimosaceous shrub (D. S. Verity). *Paratypes,* a male from Sabino Canyon, Santa Catalina Mountains, Arizona, September 5, 1957 (R. L. Westcott), a male from Mocuzari, Sonora, Sep-

tember 25 (R. L. Westcott), and a male from Santa Ana, Sonora, July 22, 1940 (R. P. Allen).

What I assume to be females of this subspecies were taken in the vicinity of Alamos, Sonora, by R. L. Westcott as follows: two examples, Alamos, Sonora, July 30–August 9, 1957, one example 8 miles west of Alamos, August 9, 1957, and one example 18 miles west of Alamos, July 30, 1957. In addition to the usual sexual differences in the structure of the abdomen, development of the eyes, etc., these differ from the male by having the head, pronotum, and sides of mesosternum red, the basal antennal segments yellowish rather than black, the legs yellow with the claviform portion of the intermediate and posterior femora piceous brown, that of the anterior femora clouded with piceous, the first two abdominal segments piceous brown basally, last three segments brown, the elytra without a black basal and humeral area and the pubescent patches of the pronotal and meso- and metasternal margins golden instead of white. In this last respect they resemble the female of typical *O. aurocincta* Bates (1873) from Yucatan more closely than that of the "variety" *nigroapicalis* Fisher (1947) from Vera Cruz. From both, however, they differ in the red head and pronotum.

The species of *Odontocera* exhibit great diversity of form, some species resembling meliponid bees, others vespid wasps. This resemblance carries over to the flight habits of the beetles (Bates, 1873), and Wheeler and Darlington (1930) have not only recorded vespid-like flight for *O. triplaris* Fisher,[1] but the occurrence of a similarly colored vespid [2] with them. The present species is much more wasp-like than bee-like. If both sexes are mimetic they presumably have quite different models, in view of the dichromatism which they exhibit.

[1] The species of *Odontocera* referred to by Wheeler and Darlington were subsequently described by Fisher as follows: no. 7 (p. 110) as *O. triplaris* and no. 9 (p. 111) as *O. darlingtoni*.

[2] The vespid has been tentatively identified as *Polybia emaciata* Luc., a species widely distributed in Tropical America. It shares similar coloration not only with vespids of similar genera, but also, as pointed out to me by H. E. Evans, with a trigonalid and a pompilid.

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## Herpetomonas muscarum (Leidy) in the Haemocoele of Larval Musca domestica L.[1]

By JOHN PAUL KRAMER, Illinois Natural History Survey, Urbana, Illinois

In late September, 1959, the author collected 61 sluggish and immobile larvae of *Musca domestica* L. from mounds of insecticide-free chicken feces at a farm near Tolono, Illinois. These larvae, which were well-developed third instars, were brought back to the laboratory for study. Fifty-seven of them responded vigorously to light raps with a blunt probe, and, in addition, exhibited pulsation of the dorsal vessel. A single larva did not respond to the aforementioned tactile stimulus although a faint pulsation of the dorsal vessel was visible. The three remaining larvae were considered dead since they neither responded to the probe nor was pulsation of the dorsal vessel observable. As a matter of routine each whole larva was examined microscopically in order to detect gross changes, if any, in its organs.

No abnormalities were noticed among the 57 active larvae. On the other hand, the haemolymph of the single moribund larva and of the three dead larvae was teeming with the long slender protozoan, *Herpetomonas muscarum* (Leidy) (Flagellata: Trypansomatidae). The microparasites could be observed through the integument of the larvae without dissection. No evidence of decay or mechanical injury was present in these four larvae.

[1] This investigation was supported in part by Research Grant E-1231 from the National Institute of Allergy and Infectious Diseases of the National Institutes of Health, Public Health Service.

Thus it is evident that *M. muscarum* does gain entry to the haemocoele of the host in some instances. Further it seems possible that *H. muscarum* may be a facultative pathogen under these circumstances. This is noteworthy since *H. muscarum* is generally considered a benign parasite which is restricted to the alimentary tract of adult muscoid flies in nature (Steinhaus 1949, and West 1951).

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